

Item Specifications: Algebra 1

A1.1 Core Content: Solving Problems (Algebra)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Items assessing A1.1 may expect students to define the variables used in an equation or inequality.
- Items assessing A1.1 may expect students to use a given function to solve the problem and interpret the solution in the context of the original situation.
- Items assessing A1.1 may expect students to represent a word problem as an equation, inequality, or system of equations or inequalities.
- Items assessing A1.1 may include step functions and those that contain the absolute value of an expression.
- Step functions will be described verbally or graphically, not symbolically.
- The absolute value of an expression will be represented in an equation, inequality, or graph.
- Short-Answer items assessing A1.1.A will include linear or exponential growth functions only.
- Multiple-choice items assessing A1.1.A may include linear, exponential, or quadratic functions.
- Items assessing A1.1.E will include functions of the form $y = ab^x$ where b may be less than 1.
- Items assessing A1.1.E may ask students to approximate solutions for x in the equation $y = ab^x$ and, when possible, give answers that are numerically exact.

Content Expectations

Items may ask students to:	Integrated Sequence		C.C.	Format	Ctxt
A1.1.A Select and justify functions and equations to model and solve problems.	M1.1.A	M2.1.A	2	MC,SA	Y
A1.1.B Solve problems that can be represented by linear functions, equations, and inequalities.	M1.1.B		2	CP,SA	Y
A1.1.C Solve problems that can be represented by a system of two linear equations or inequalities.	M1.1.C		2	CP,SA	Y
A1.1.D Solve problems that can be represented by quadratic functions and equations.		M2.1.C	2	CP	Y
A1.1.E Solve problems that can be represented by exponential functions and equations.	M1.1.D	M2.1.D	2	MC,CP	Y

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A1.2 Core Content: Numbers, expressions, and operations

(Numbers, Operations, Algebra)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Real numbers include those written in scientific notation or expressed as fractions, decimals, exponentials, or roots.
- Expressions may include radicals, absolute values, and integer exponents.
- Algebraic properties include the identity, zero, commutative, associative, and distributive properties.
- Items assessing A1.2 may expect students to write algebraic expressions in equivalent forms using algebraic properties and to perform the four arithmetic operations with polynomials.
- Items assessing A1.2.C may ask students to write an answer in simplest radical form.

Content Expectations

Items may ask students to:	Integrated Sequence	C.C.	Format	Ctxt
A1.2.A <i>Know the relationship between real numbers and the number line, and compare and order real numbers with and without the number line.</i>	M1.6.A	1	MC	I
A1.2.B <i>Recognize the multiple uses of variables, determine all possible values of variables that satisfy prescribed conditions, and evaluate algebraic expressions that involve variables.</i>	M1.6.C	1,(2)	MC,CP	N
A1.2.C <i>Interpret and use integer exponents and square and cube roots, and apply the laws and properties of exponents to simplify and evaluate exponential expressions.</i>	M1.7.C	1	MC,CP	N
A1.2.D <i>Determine whether approximations or exact values of real numbers are appropriate, depending on the context, and justify the selection.</i>	M1.6.B	(2,3)	NA	NA
A1.2.E <i>Use algebraic properties to factor and combine like terms in polynomials.</i>	M2.5.A	1	MC	N
A1.2.F <i>Add, subtract, multiply, and divide polynomials.</i>	M3.6.C	(1)	NA	NA

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A1.3 Core Content: Characteristics and behaviors of functions (Algebra)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Items assessing A1.3 may include linear, quadratic, exponential, step functions and those that contain the absolute value of an expression.
- Items assessing A1.3 may expect students to understand $f(x) = \frac{a}{x}$ represents an inverse variation.
- Items assessing A1.3 may include equations involving square and cube roots, absolute values, or exponents.
- Items assessing A1.3.A may expect students to describe further restrictions on the domain of a function appropriate for a given problem situation.
- Items assessing A1.3.B will use at least two of the four representations (expression, graph, table, or in words).
- Items assessing A1.3.C may represent a function as an equation, table, graph, or in words.
- Items may present the range or domain of a function symbolically ($x > 3$) or in words ("all real numbers greater than 3"). Items will not use interval $[-3, 4)$ or set notation $\{x|x \leq 4\}$.
- Items may present relationships as an equation or inequality; in a chart, table, or graph; or in words.
- Step functions will be described verbally or graphically, not symbolically.
- The absolute value of an expression will be represented in an equation, inequality, or graph.

Content Expectations

Items may ask students to:	Integrated Sequence	C.C.	Format	Ctxt
A1.3.A Determine whether a relationship is a function and identify the domain, range, roots, and independent and dependent variables.	M1.2.A	1,2	MC,SA	I
A1.3.B Represent a function with a symbolic expression, as a graph, in a table, and using words, and make connections among these representations.	M1.2.B	2	MC,SA	I
A1.3.C Evaluate $f(x)$ at a (i.e., $f(a)$) and solve for x in the equation $f(x) = b$.	M1.2.C	1	MC,CP	N

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A1.4 Core Content: Linear functions, equations, and inequalities
(Algebra)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Items assessing A1.4.A may include the absolute value of an expression.
- Items assessing A1.4.A may expect students to identify the solution to inequalities on a number line.
- Items assessing A1.4.A may include compound inequalities.
- Items assessing A1.4.B may present an equation of a line in standard form, point-slope form, or slope-intercept form.
- Answer choices will all be presented in the same form (standard, point-slope, or slope-intercept).
- Intercepts will be represented with ordered pairs, (x,y) .
- Items assessing A1.4.D may expect students to solve symbolic problems using a variety of methods (addition, subtraction, substitution) and understand that the solution to a system of equations is given by the coordinates of the intersection of the two lines and the solution set to a system of inequalities is a region of the coordinate plane when the lines are graphed in the same coordinate plane.
- Items assessing A1.4.D may ask students to determine the value of one or both variables in the solution to the system.
- Items assessing A1.4.D may include a blank grid; only the answer choice (Multiple-Choice Items) or the student answer (Completion Items) is scored.
- Items assessing A1.4.E may ask students to describe the relationship between functions in the form $y = mx+b$ or $y = a|x-h|+k$ to the parent functions $y = x$ and $y = |x|$.
- Items that require students to both write and solve an equation, inequality, or system will be assessed in A1.1.

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Content Expectations

Items may ask students to:	<i>Integrated Sequence</i>	<i>C.C.</i>	<i>Format</i>	<i>Ctxt</i>
A1.4.A <i>Write and solve linear equations and inequalities in one variable.</i>	M1.3.A	1,2	MC,CP	N
A1.4.B <i>Write and graph an equation for a line given the slope and the y-intercept, the slope and a point on the line, or two points on the line, and translate between forms of linear equations.</i>	M1.3.D	1	MC	N
Items may ask students to:	<i>Integrated Sequence</i>	<i>C.C.</i>	<i>Format</i>	<i>Ctxt</i>
A1.4.C <i>Identify and interpret the slope and intercepts of a linear function, including equations for parallel and perpendicular lines.</i>	M1.3.C	1	MC	I
A1.4.D <i>Write and solve systems of two linear equations and inequalities in two variables.</i>	M1.3.E	1,2	MC,CP	N
A1.4.E <i>Describe how changes in the parameters of linear functions and functions containing an absolute value of a linear expression affect their graphs and the relationships they represent.</i>	M1.3.B	1,2	MC,SA	N

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✱ A1.5 Core Content: Quadratic functions and equations (Algebra)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Items assessing A1.5.D may expect students to give approximate solutions or numerically exact solutions. When an item does not specify, students may do either.

Content Expectations

Items may ask students to:	<i>Integrated Sequence</i>	<i>C.C.</i>	<i>Format</i>	<i>Ctxt</i>
A1.5.A Represent a quadratic function with a symbolic expression, as a graph, in a table, and with a description, and make connections among the representations.	M2.2.A	2	MC	I
A1.5.B Sketch the graph of a quadratic function, describe the effects that changes in the parameters have on the graph, and interpret the x-intercepts as solutions to a quadratic equation.	M2.2.B	1,2	MC	I
A1.5.C Solve quadratic equations that can be factored as $(ax + b)(cx + d)$ where a , b , c , and d are integers.	M2.2.D	1,2	MC,CP	N
A1.5.D Solve quadratic equations that have real roots by completing the square and by using the quadratic formula.	M2.2.F	1,2	MC,CP	N

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A1.6 Core Content: Data and distributions

(Data/Statistics/Probability)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Items assessing A1.6 may expect students to use statistical language to explain a comparison, inference, or conclusion.
- Items assessing A1.6.A may present data sets numerically or graphically.
- Items assessing A1.6.A may expect students to compute and/or evaluate the appropriateness of different measures of center and variability to describe one or more data sets.
- Items assessing A1.6.B may expect students to determine whether arguments based on data confuse association with causation.
- Items assessing A1.6.B may expect students to evaluate the reasonableness of and make judgments about statistical claims, reports, studies, and conclusions.
- Items assessing A1.6.D may expect students to make predictions involving interpolating and extrapolating from the original data set.
- Items assessing A1.6.D will ask students to draw a line that fits the data rather than a line of best fit.

Content Expectations

Items may ask students to:	Integrated Sequence	C.C.	Format	Ctxt
A1.6.A Use and evaluate the accuracy of summary statistics to describe and compare data sets.	M1.5.A	2	MC,SA	Y
A1.6.B Make valid inferences and draw conclusions based on data.	M1.5.C	2,3	MC,SA	Y
A1.6.C Describe how linear transformations affect the center and spread of univariate data.	M1.5.B	2	MC	Y
A1.6.D Find the equation of a linear function that best fits bivariate data that are linearly related, interpret the slope and y-intercept of the line, and use the equation to make predictions.	M1.3.F	2	MC,SA	Y
A1.6.E Describe the correlation of data in scatterplots in terms of strong or weak and positive or negative.	M1.3.G	1	MC	I

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A1.7 Additional Key Content

(Algebra)

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Items assessing A1.7 will not ask students to write exponential functions or equations.
- Items assessing A1.7.A may ask students to make comparisons between exponential functions.
- Items assessing A1.7.B may expect students to approximate solutions for x and, when possible, give answers for x that are numerically exact.
- Items assessing A1.7.B will include equations of the form $y = ab^x$ where b is greater than 1.
- Items assessing A1.7.C that give a formula for an will clarify that a_1 is the first term in the sequence.
- Recursive and explicit forms will be represented using subscript notation, i.e.,
 $t_n = t_{n-1} + 9$ or $a_n = 3(n - 2) + 5$.
- Items assessing A1.7.D will include a maximum of four variables in an equation.

Content Expectations

Items may ask students to:	Integrated Sequence	C.C.	Format	Ctxt
A1.7.A Sketch the graph for an exponential function of the form $y = ab^n$ where n is an integer, describe the effects that changes in the parameters a and b have on the graph, and answer questions that arise in situations modeled by exponential functions.	M1.7.A	1,2	MC,SA	I
A1.7.B Find and approximate solutions to exponential equations.	M1.7.B	2	MC	N
A1.7.C Express arithmetic and geometric sequences in both explicit and recursive forms, translate between the two forms, explain how rate of change is represented in each form, and use the forms to find specific terms in the sequence.	M1.7.D	1,2	MC,CP	N
A1.7.D Solve an equation involving several variables by expressing one variable in terms of the others.	M1.6.D	1,2	MC	N

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A1.8 Core Processes: Reasoning, problem solving, and communication

Stimulus, Stem, and Prompt Rules

- Use Item Development Guidelines at the beginning of this document.
- Problem solving items will include A1.8.A, A1.8.B, A1.8.C.
- Items assessing A1.8.A-C may include figures that are not drawn to scale and include a statement "Picture is not drawn to scale."
- Items assessing A1.8.G may ask a student to support or contradict a given conclusion.
- Mathematics content for process items must be from performance expectations that are common to Algebra 1 and Mathematics 1.

Content Expectations

Items may ask students to:	Integrated Sequence	C.C.	Format	Ctxt
A1.8.A Analyze a problem situation and represent it mathematically.	M1.8.A-C	3	MC,SA	Y
A1.8.B Select and apply strategies to solve problems.				
A1.8.C Evaluate a solution for reasonableness, verify its accuracy, and interpret the solution in the context of the original problem.				
A1.8.D <i>Generalize a solution strategy for a single problem to a class of related problems, and apply a strategy for a class of related problems to solve specific problems.</i>	M1.8.D	(3,4)	NA	NA
A1.8.E Read and interpret diagrams, graphs, and text containing the symbols, language, and conventions of mathematics.	M1.8.E	2,3	SA	Y
A1.8.F <i>Summarize mathematical ideas with precision and efficiency for a given audience and purpose.</i>	M1.8.F	(2,3)	NA	NA
A1.8.G Synthesize information to draw conclusions, and evaluate the arguments and conclusions of others.	M1.8.G	3	MC,SA	Y
A1.8.H <i>Use inductive reasoning about algebra and the properties of numbers to make conjectures, and use deductive reasoning to prove or disprove conjectures.</i>	M1.8.H	(4)	NA	NA

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